

CLAIMS

1. An apparatus for performing quality inspections on a test surface comprising:
a device for producing optical radiation having a plurality of different spectrum lines, selecting at least one of the spectrum lines, and directing the selected spectrum line to the test surface; and
circuitry for detecting a current of photoelectrons emitted from the test surface, generating a signal indicative of photoelectron current, and indicating a condition of quality based on the generated signal indicative of photoelectron current.
2. The apparatus according to claim 1 wherein the device comprises an ultraviolet optical radiation source.
3. The apparatus according to claim 2 wherein the ultraviolet optical radiation source comprises an ultraviolet laser.
4. The apparatus according to claim 3 wherein the laser comprises a tunable laser.
5. The apparatus according to claim 2 wherein the ultraviolet optical radiation source comprises an excimer lamp.
6. The apparatus according to claim 2 wherein the ultraviolet optical radiation source comprises a plurality of Microhollow Cathode Discharge lamps.
7. The apparatus according to claim 1 wherein the selecting device comprises a filtering device that filters the optical radiation directed to the test surface.

8. The apparatus according to claim 7 wherein the filtering device comprises a plurality of filtering sections, each filtering section allowing at least one particular spectrum line to pass therethrough.
9. The apparatus according to claim 8 wherein a first one of the plurality of filtering sections allows only a first spectrum line to pass therethrough, a second one of the filtering sections allows only a second spectrum line to pass therethrough, and a third one of the plurality of filtering sections allows only the first and second spectrum lines to pass therethrough.
10. The apparatus according to claim 9 wherein the filtering device has a first state that enables only the first one of the filtering sections to filter the optical radiation, a second state that enables only the second one of the filtering section to filter the optical radiation, and a third state that enables only the third filtering section to filter the optical radiation.
11. The apparatus according to claim 10 wherein a fourth one of the plurality of filtering sections allows all spectrum lines to pass to the test surface, the filtering device further including a fourth state that allows only the fourth filtering section to filter the optical radiation.
12. The apparatus according to claim 8 wherein each of the filtering sections comprises diffraction gratings.
13. The apparatus according to claim 8 wherein each of the filtering sections comprises a dielectric filter.

14. The apparatus according to claim 1 wherein the detecting circuitry includes a collector for collecting the photoelectron current and means for positively biasing the collector with respect to the test surface.
15. The apparatus according to claim 14 further comprising means for negatively biasing the collector with respect to the test surface to replace charges removed as photoelectron current from the test surface by the previously positively biased collector.
16. The apparatus according to claim 1 wherein the indicating circuitry comprises an arrangement for evaluating the generated signal to thus distinguish between at least one of:
- surface contamination and oxidation; and
 - different species of contaminants.
17. An apparatus for performing quality inspections on a test surface comprising:
- means for producing optical radiation having a plurality of different spectrum lines, selecting at least one of the spectrum lines, and directing the selected spectrum line to the test surface; and
 - means for detecting a current of photoelectrons emitted from the test surface, generating a signal indicative of photoelectron current, and indicating a condition of quality based on the generated signal indicative of photoelectron current.
18. The apparatus according to claim 17 wherein the means for indicating a condition of quality based on the generated signal indicative of photoelectron current comprises means for discerning at least one of:
- surface contamination;
 - surface corrosion; and
 - different species of contaminants.

19. An apparatus for performing quality inspections on a test surface based on optically stimulated emission of electrons comprising:

- an optical radiation source for producing optical radiation having a plurality of different spectrum lines;

- a selection device for selecting at least one of the spectrum lines and directing the selected spectrum line to the test surface;

- circuitry for detecting a current of photoelectrons emitted from the test surface and generating a signal indicative of the detected photoelectron current; and

- circuitry for indicating a condition of quality based on the generated signal indicative of photoelectron current.

20. The apparatus according to claim 19 wherein the circuitry for indicating a condition of quality comprises circuitry for evaluating the generated signal indicative of photoelectron current to thereby discriminate between at least one of:

- surface contamination and corrosion; and

- different species of contaminants.

21. An apparatus for performing quality inspections on a test surface comprising:

- a multi-state device for producing optical radiation in the direction of the test surface, the optical radiation defining a particular spectrum line that corresponds to a particular state of the device wherein each state of the device effects generation of at least one particular spectrum line;

- circuitry for successively configuring the device into different states; and

- additional circuitry for detecting a current of photoelectrons emitted from the test surface, generating a signal indicative of photoelectron current, and indicating a condition of quality based on the generated signal indicative of photoelectron current.

22. The apparatus according to claim 21 wherein the additional circuitry detects a current of photoelectrons emitted from the test surface for each state of the multi-state device, the additional circuitry including circuitry for combining the detected current of photoelectrons emitted from the test surface for each state of the multi-state device into a single detection signal, the additional circuitry being configured so that the indicated condition of quality is based upon the single detection signal.
23. A method for performing quality inspections on a test surface comprising:
- a. producing optical radiation having a plurality of different spectrum lines of optical radiation;
 - b. selecting at least one of the spectrum lines and directing the at least one selected spectrum line to the test surface;
 - c. detecting a current of photoelectrons emitted from the test surface and generating a signal indicative of photoelectron current; and
 - d. indicating a condition of quality based on the generated signal indicative of the photoelectron current.
24. The method according to claim 23 wherein the step of indicating comprises the step of evaluating the generated signal indicative of the photoelectron current to determine whether the test surface has experienced corrosion.
25. The method according to claim 23 wherein the step of indicating comprises the step of evaluating the generated signal indicative of the photoelectron current to determine whether the test surface has experienced contamination.
26. The method according to claim 23 wherein the step of indicating comprises the step of evaluating the generated signal indicative of the photoelectron current to determine what species of contaminant the test surface has experienced.

27. The method according to claim 23 wherein selecting at least one of the spectrum lines comprises filtering the plurality of different spectrum lines.
28. The method according to claim 23 wherein selecting at least one of the spectrum lines comprises enabling all spectrum lines to pass to the test surface.
29. The method according to claim 23 wherein steps b-d are repeated for each selection of spectrum lines.
30. A method for performing quality inspections on a test surface based on optically stimulated emission of electrons comprising:
producing a plurality of different spectrum lines of optical radiation;
filtering the plurality of spectrum lines so as to allow at least one of the spectrum lines to pass to the test surface;
detecting a current of photoelectrons emitted from the test surface and
generating a signal indicative of photoelectron current; and
indicating a condition of quality based on the generated signal indicative of the photoelectron current.
31. The method according to claim 30 wherein the step of indicating comprises the step of evaluating the generated signal indicative of the photoelectron current to determine whether the test surface has experienced corrosion.
32. The method according to claim 30 wherein the step of indicating comprises the step of evaluating the generated signal indicative of the photoelectron current to determine whether the test surface has experienced contamination.

33. The method according to claim 30 wherein the step of indicating comprises the step of evaluating the generated signal indicative of the photoelectron current to determine what species of contaminant the test surface has experienced.

34. A method for performing quality inspections on a test surface comprising:
providing a multi-state device for producing optical radiation, the optical radiation defining a particular spectrum line that corresponds to a particular state of the device wherein each state of the device effects generation of a particular spectrum line;
successively configuring the device into different states;
directing to the test surface the spectrum lines corresponding to each state of the device;
detecting a current of photoelectrons emitted from the test surface;
generating a signal indicative of photoelectron current; and
indicating a condition of quality based on the generated signal indicative of photoelectron current.

35. The method according to claim 34 wherein the detecting step comprises detecting a current of photoelectrons emitted from the test surface for each state of the multi-state device.

36. The method according to claim 35 wherein:
the step of generating a signal indicative of photoelectron current comprises the step of combining the detected current of photoelectrons emitted from the test surface for each state of the multi-state device into a single detection signal; and
the step of generating a signal indicative of photoelectron current comprises the step of generating a signal indicative of photoelectron current based upon the single detection signal.

37. A method for performing quality inspections on a test surface comprising the steps of:

- providing optical radiation having a continuum spectrum;
- selecting a band of wavelengths from the continuum and directing the selected spectrum band to the test surface;
- detecting a current of photoelectrons emitted from the test surface; and
- generating a signal indicative of photoelectron current, and evaluating the generated signal so as to determine a condition of quality.

38. The method according to claim 37 wherein the step of evaluating comprises evaluating the generated signal indicative of the photoelectron current to determine whether the test surface has experienced corrosion.

39. The method according to claim 37 wherein the step of evaluating comprises evaluating the generated signal indicative of the photoelectron current to determine whether the test surface has experienced contamination.

40. The method according to claim 37 wherein the step of evaluating comprises evaluating the generated signal indicative of the photoelectron current to determine what species of contaminant the test surface has experienced.

41. An apparatus for performing quality inspections on a test surface comprising:
means for producing optical radiation having a continuum spectrum, selecting a band of at least one wavelength from the continuum, and directing the selected band to the test surface; and
means for detecting a current of photoelectrons emitted from the test surface, generating a signal indicative of photoelectron current, and indicating a condition of quality based on the generated signal indicative of photoelectron current.

42. The apparatus according to claim 41 wherein the means for producing optical radiation comprises a deuterium lamp.
43. The apparatus according to claim 41 wherein the selecting means comprises a filtering device that filters the optical radiation directed to the test surface.
44. The apparatus according to claim 43 wherein the filtering device comprises a plurality of filtering sections, each filtering section allowing at least one particular spectrum band to pass therethrough.
45. The apparatus according to claim 44 wherein a first one of the plurality of filtering sections allows only a first spectrum band to pass therethrough, a second one of the filtering sections allows only a second spectrum band to pass therethrough, and a third one of the plurality of filtering sections allows only the first and second spectrum bands to pass therethrough.
46. The apparatus according to claim 45 wherein the filtering device has a first state that enables only the first one of the filtering sections to filter the optical radiation, a second state that enables only the second one of the filtering section to filter the optical radiation, and a third state that enables only the third filtering section to filter the optical radiation.
47. The apparatus according to claim 46 wherein a fourth one of the plurality of filtering sections allows all spectrum bands to pass to the test surface, the filtering device further including a fourth state that allows only the fourth filtering section to filter the optical radiation.
48. The apparatus according to claim 44 wherein each of the filtering sections comprises diffraction gratings.

49. The apparatus according to claim 44 wherein each of the filtering sections comprises a dielectric filter.
50. The apparatus according to claim 41 wherein the detecting means includes a collector for collecting the photoelectron current and means for positively biasing the collector with respect to the test surface.
51. The apparatus according to claim 50 further comprising means for negatively biasing the collector with respect to the test surface to replace charges removed as photoelectron current from the test surface by the previously positively biased collector.
52. The apparatus according to claim 41 wherein the means for indicating a condition of quality based on the generated signal indicative of photoelectron current comprises means for evaluating the generated signal to thus discern at least one of:
- surface contamination;
 - surface oxidation; and
 - different species of contaminants.
53. The apparatus according to claim 48 wherein each of the diffraction gratings comprise a slit, thereby permitting the at least one particular spectrum band to pass therethrough.